REMARKS

The Application has been carefully reviewed in light of the Office Action dated March 18, 2002 (Paper No. 9). Claims 1 to 58 are in the application, of which Claim 1 is the independent claim. Claims 1 to 6, 24, 28, 30 and 32, have been amended herein. Claims 36 and 42 have been cancelled without prejudice or disclaimer of the subject matter contained therein. Reconsideration and further examination are respectfully requested.

Applicants have cancelled Claim 36 thereby rendering moot the double patenting rejection, and Applicants respectfully request withdrawal of the rejection.

Applicants have amended the Abstract to address the objection raised in the Office Action, and withdrawal of the objection is respectfully requested.

With regard to the 35 U.S.C. § 112 rejection of the claims, Applicants have amended Claim 1 to include the elements recited in Claims 24 to 35 and 39 to 40. Support for this amendment may be found in the originally-filed specification at page 28, lines 6 to 16 and page 54, line 13 to page 55, line 13, wherein it is described that, in addition to the Sn element, the amorphous Sn•A•X alloy may contain the indicated non-transitional metal elements. In addition, Applicants have cancelled Claim 42. Accordingly, Applicants request reconsideration and withdrawal of the § 112 rejection.

Claims 1, 10, 12 to 16, 36 to 38 and 41 to 48 have been rejected under 35 U.S.C. § 102(e) over U.S. Patent 6,007,945 (Jacobs), Claims 2 to 9 have been rejected under 35 U.S.C. § 102(e) or, in the alternative, under 35 U.S.C. § 103(a) over Jacobs, and Claims 1, 10 to 22, 24 to 39 and 41 to 58 have been rejected under 35 U.S.C. § 102(e) over U.S. Patent 5,780, 181 (Idota).

In a conventional rechargeable lithium battery, anode deterioration is caused by repeated charging/discharging of the battery over time.

The present invention addresses the foregoing problem and concerns an electrode material for use in an electrode structural body for an anode of a rechargeable lithium battery. The rechargeable lithium battery having the electrode structural body of the present invention has a prolonged charging and discharging cycle life, provides a gently-sloping discharge curve, and has a high capacity and high energy density.

The electrode material according to the present invention contains a particulate having an amorphous Sn•A•X alloy with a substantially non-stoichiometric ratio composition. In the Sn•A•X formula, A represents at least one kind of an element selected from a group of transition metal elements, and X, which need not be contained in the alloy, represents at least one kind of an element selected from a group consisting of O, F, N, Mg, Ba, Sr, Ca, La, Ce, Si, Ge, C, P, B, Pb, Bi, Sb, Al, Ga, In, Tl, Zn, Be, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, As, Se, Te, Li and S. The content of the constituent element Sn of the amorphous alloy is Sn/(Sn+A+X) equal to 20 to 80 atomic % in terms of the number of atoms in each element of the constituents elements Sn, A and X.

With reference to the specific language of the claim, Claim 1 concerns an electrode material for an anode of a rechargeable lithium battery. The electrode material containing a particulate comprising an amorphous Sn•A•X alloy with a substantially non-stoichiometric ratio composition,. In the Sn•A•X formula, A indicates at least one kind of an element selected from the group consisting of transition metal elements, X indicates at least one kind of an element selected from the group consisting of O, F, N, Mg, Ba, Sr, Ca, La, Ce, Si, Ge, C, P, B, Pb, Bi, Sb, Al, Ga, In, Tl, Zn, Be, Pr, Nd, Sm, Eu, Gd,

Tb, Dy, Ho, Er, Tm, Yb, Lu, As, Se, Te, Li and S. X is optionally present and the content of the constituent element Sn of the amorphous Sn•A•X alloy is Sn/(Sn + A + X) = 20 to 80 atomic%.

The applied art, namely Jacobs and Idota, is not seen to teach or to suggest the amorphous Sn•A•X alloy of Claim 1.

More particularly, Jacobs is seen to describe an electrode for a rechargeable lithium battery that comprises a solid solution of titanium dioxide and tin dioxide. Jacobs is not seen to teach or to suggest using an alloy having Sn and one or more transition metal elements with or without one or more of the elements given in X.

As indicated in the cited portions of Jacobs (i.e., col. 3, lines 55 to 67 and col. 4, lines 35 to 40), Jacobs is seen to describe a titanium dioxide-tin dioxide mixture. The oxide mixture is such that the ratio of titanium dioxide to tin dioxide is similar to a ratio of titanium to tin in one of the intermetallic compounds listed in Table 1 (col. 4, lines 1 to 9). However, Jacobs is not seen to teach or to suggest using any of the intermetallic compounds in, or as for that matter, the mixture.

In the description of Example 1, for example, beginning at col. 4, line 61 of Jacobs, the mixture of titanium dioxide and tin dioxide was prepared such that the ratio of the weight of titanium dioxide to the weight of tin dioxide was similar to the ratios for the Ti_6Sn_5 intermetallic compound ratio, or 39 to 61. The mixture of Example 1 is not the Ti_6Sn_5 intermetallic compound.

Thus, Jacobs is merely seen to suggest using ratios for the titanium dioxide-tin dioxide mixture based on ratios associated with the identified intermetallic compounds,

and is not seen to use the intermetallic compound in the titanium dioxide-tin dioxide mixture.

Idota is not seen to remedy the deficiencies of Jacobs. Nothing in Idota is seen to describe the amorphous Sn•A•X alloy recited in Claim 1. That is, Idota is not seen to teach or to suggest an alloy of Sn and at least one transition metal with or without one or more elements from X. The claimed Sn•A•X alloy is not seen to be shown in any of the compounds listed in cols. 5 and 6, and nothing in the remaining portions of Idota cited in the Office Action is seen to teach or to suggest such an alloy.

Therefore, for at least the foregoing reasons, Claim 1 is believed to be in condition for allowance.

The remaining claims are each dependent from the independent claims discussed above and are therefore believed patentable for the same reasons. Because each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration of each on its own merits is respectfully requested.

In view of the foregoing, the entire application is believed to be in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

REQUEST FOR PERSONAL INTERVIEW

Should the Examiner find that the foregoing does not place the entire application into condition for allowance, the Examiner is respectfully requested to contact the undersigned attorney to schedule a personal interview.

Applicants' undersigned attorney may be reached in our Costa Mesa, California office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,

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APPENDIX

VERSION WITH MARKINGS SHOWING CHANGES MADE TO THE ABSTRACT

Please amend the Abstract of the Disclosure, at page 136, lines 1 to 19, to read as follows:

ABSTRACT OF THE DISCLOSURE

An electrode material for an anode of a rechargeable lithium battery, containing a particulate comprising an amorphous Sn•A•X alloy with a substantially non-stoichiometric ratio composition. [( ] For said formula Sn•A•X, A indicates at least one kind of an element selected from a group consisting of transition metal elements, X indicates at least one kind of an element selected from a group consisting of O, F, N, Mg, Ba, Sr, Ca, La, Ce, Si, Ge, C, P, B, Pb, Bi, Sb, Al, Ga, In, Tl, [and] Zn, Be, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, As, Se, Te, Li and S, where the element X is not always necessary to be contained. The content of the constituent element Sn of the amorphous Sn•A•X alloy is Sn/(Sn +A + X) = 20 to 80 atomic%. [ )] An electrode structural body for a rechargeable lithium battery, comprising said electrode material for an anode and a collector comprising a material incapable of being alloyed with lithium in electrochemical reaction, and a rechargeable lithium battery having an anode comprising said electrode structural body.

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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Twice Amended) An electrode material for an anode of a rechargeable lithium battery, containing a particulate comprising an amorphous Sn•A•X alloy with a substantially non-stoichiometric ratio composition, wherein in said formula Sn•A•X, A indicates at least one kind of an element selected from the group consisting of transition metal elements, X indicates at least one kind of an element selected from the group consisting of O, F, N, Mg, Ba, Sr, Ca, La, Ce, Si, Ge, C, P, B, Pb, Bi, Sb, Al, Ga, In, Tl, [and] Zn, Be, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, As, Se, Te, Li and S, where the element X is optionally present and the content of the constituent element Sn of the amorphous Sn•A•X alloy is Sn/(Sn + A + X) = 20 to 80 atomic%.

2. (Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy has a peak [appeared] in a range of $2\theta = 25°$ to 50° in X-ray diffraction pattern obtained using a Cu Kα [-rays of Cu as a] radiation source, having a half width of more than 0.2°.

3. (Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy has a peak [appeared] in a range of $2\theta = 25°$ to 50° in X-ray diffraction pattern obtainined using a Cu Kα [-rays of Cu as a] radiation source, having a half width of more than 0.5°.

4. (Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy has a peak[appeared] in a range of $2\theta = 25°$ to 50° in X-ray diffraction pattern obtained using a Cu Kα [-rays of Cu as a] radiation source, having a half width of more than 1.0°.

5. (Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy has a peak [appeared] in a range of $2\theta = 40°$ to 50° in X-ray diffraction pattern obtained using a Cu Kα [-rays of Cu as a] radiation source, having a half width of more than 0.5°.

6. (Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy has a peak [appeared] in a range of $2\theta = 40°$ to 50° in X-ray diffraction pattern obtained using a Cu Kα [-rays of Cu as a] radiation source, having a half width of more than 1.0° .

24. (Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy contains at least one kind of an element selected from a group (a) consisting of Pb, Bi, Al, Ga, In, Tl, Zn, Be, Mg, Ca, and Sr; a group (b) consisting of rare earth elements in X; and a group (c) consisting of metalloide elements in X.

28. (Amended) An electrode material for an anode according to claim 1,

wherein said amorphous Sn•A•X alloy contains one kind of an element selected from a group consisting of Pb, Bi, A1, Ga, In, T1, Zn, Be, Mg, Ca, and Sr and one kind of an element selected from a group consisting of rare earth elements in X.

30. (Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy contains one kind of an element selected from a group consisting of Pb, Bi, A1, Ga, In, T1, Zn, Be, Mg, Ca, and Sr and one kind of an element selected a group consisting of metalloide elements in X.

32. (Amended) An electrode material for an anode according to claim 1, wherein said amorphous Sn•A•X alloy contains[,] at least[,] one kind of an element selected from a group consisting of metalloide elements in X and one kind of an element selected a group consisting of rare earth elements in X.

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